Semester: III	Department of Electronics and Communication Engineering	AY: 2026-27
Course Code: BEC303	Course Name: Analog Electronics and Linear Integrated Circuits	

Question Bank

Q.	Module-01	M	L	C
1.	With a neat circuit diagram, explain the voltage divider bias (VDB) circuit of a transistor and derive the expressions for its Q-point. Also list the steps in its simplified analysis.	10	L2	CO1
2.	Analyze a VDB amplifier circuit with respect to the DC equivalent circuit, the AC π-model and the AC T-model.	7	L4	CO1
3.	Design a positive and a negative biased clipper circuit.	6	L3	CO1
4.	With the importance of coupling capacitors, explain the base-biased amplifier circuit and its AC equivalent circuit. Support your answer with base current, collector current and collector voltage, and draw the voltage waveforms.	10	L2	CO1
5.	Explain the basic idea of the Common-Collector (CC) amplifier. Give the mathematical relations for AC emitter resistance (r′e), voltage gain (Av), input impedance of the base Zin(base) and input impedance of the stage Zin(stage).	8	L2	CO1
6.	Derive the expressions for Vin, Vout and Av for a common-emitter circuit with its AC equivalent circuit using the π-model.	10	L3	CO1
7.	With a neat diagram, explain the two transistor models (π-model and T-model). Also derive Zin(base).	10	L3	CO1
8.	With a neat diagram, explain the loading effect of input impedance.	8	L2	CO1
9.	Explain the three types of bias circuits: (i) Emitter feedback bias (ii) Collector feedback bias (iii) Collector and emitter feedback bias.	10	L2	CO1
10.	For a VDB amplifier with R1 = 10 kΩ, R2 = 2.2 kΩ, RC = 3.6 kΩ, RE = 1 kΩ, RL = 10 kΩ, VCC = 10 V, VBE = 0.7 V and Vin = 2 mV, calculate the collector-emitter voltage VCE, the voltage gain and the output voltage across the load resistor.	5	L3	CO1
	Module-02			
11.	Biasing by fixing VGS is not a good approach to bias a MOSFET. Why? Explain biasing by fixing VG and connecting a resistance in the source for a MOSFET.	8	L2	CO2
12.	Explain the three biasing methods used to bias MOS amplifiers with neat circuit diagrams.	10	L2	CO2
13.	Design a biasing circuit with fixed VG and a resistance in the source to establish a drain current ID = 0.5 mA, given Vt = 1 V, k′n(W/L) = 1 mA/V², λ = 0 and power supply VDD = 15 V.	5	L3	CO2

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14.	With a neat diagram, explain the enhancement-type n-channel MOSFET. Draw its drain and transfer (transconductance) characteristics and obtain the drain resistance (rd), mutual conductance (gm) and amplification factor (μ).	10	L2	CO2
15.	Derive an expression for the iD–vDS relationship of an NMOS transistor.	10	L3	CO2
16.	With a small-signal equivalent model of the MOSFET, derive the expressions for the DC bias point, voltage gain and transconductance for small-signal operation.	10	L3	CO2
17.	Illustrate the development of the T-equivalent circuit model for the MOSFET with a neat diagram.	8	L2	CO2
18.	Draw and explain the small-signal equivalent model of a Common-Source amplifier without source resistance and write the equations for Rin, Rout, Av and Gv.	8	L2	CO2
19.	Explain the common-source follower (source follower) and derive the expression for its voltage gain with the necessary equations.	10	L3	CO2
20.	For a Common-Gate (CG) amplifier with gm = 1 mA/V, RD = 15 kΩ, RL = 15 kΩ, Rsig = 50 Ω and RG = 4.7 MΩ, find Rin, Rout, Avo, Av and Gv.	5	L3	CO2
	Module-03			
21.	Explain the four types of negative feedback amplifiers with neat diagrams.	10	L2	CO3
22.	Explain the VCVS amplifier. Obtain its exact closed-loop voltage gain and ideal closed-loop voltage gain. Also define gain stability, closed-loop input impedance and closed-loop output impedance of a VCVS amplifier.	10	L3	CO3
23.	With a neat diagram, explain the ICVS amplifier circuit.	8	L2	CO3
24.	With a neat circuit diagram, explain the monostable operation of a 555 timer (monostable multivibrator).	10	L2	CO3
25.	With a neat diagram, explain the operation of an RC phase-shift oscillator using an op-amp. Write the expression for its frequency of oscillation.	10	L2	CO3
26.	With a neat diagram, explain the op-amp based Wien bridge oscillator circuit.	10	L2	CO3
27.	Explain the working of the Colpitts oscillator with CE connection.	6	L2	CO3
28.	With a neat diagram, explain the operation of a crystal oscillator using BJT and write the necessary equations.	6	L2	CO3
29.	With neat diagram explain current amplifier with neat circuit diagram	7	L3	CO3
30.	A crystal has the values L = 3 H, Cs = 0.05 pF, R = 2 kΩ and Cm = 10 pF. What are the series and parallel resonant frequencies of the crystal?	5	L3	CO3
	Module-04			
31.	Explain the ideal response of filters.	8	L2	CO4
32.	With a neat diagram, explain passband and stopband attenuation.	10	L2	CO4

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33.	Explain the first-order low-pass filter with its frequency response.	10	L2	CO4
34.	Explain the two types of band-pass filters.	8	L2	CO4
35.	Explain the working of a second-order VCVS high-pass filter with a neat circuit and frequency response.	10	L2	CO4
36.	Explain the Class A amplifier in terms of its power gain, output power, power dissipation and efficiency. Derive the expression for the power gain Ap.	10	L2	CO4
37.	Explain the Class B push-pull emitter follower amplifier. How can crossover distortion be eliminated?	10	L2	CO4
38.	For a Class B push-pull emitter follower with VCC = 20 V and RL = 8 Ω, calculate the maximum transistor power dissipation and the maximum output power.	8	L2	CO4
39.	Explain class C operation	7	L3	CO4
40.	Explain class B operation	5	L3	CO4
	Module-05			
41.	Design a full-wave precision rectifier using an op-amp.	10	L2	CO5
42.	Explain the R-2R ladder Digital-to-Analog Converter and derive the expression for its output voltage. How do its design and configuration contribute to accuracy in converting digital signals to analog?	10	L3	CO5
43.	Derive the expressions for Vref and the trip point of comparators with a non-zero reference.	8	L2	CO5
44.	Describe the working of an inverting Schmitt trigger circuit. How is a Schmitt trigger different from a regular comparator? Explain with the help of the hysteresis curve.	10	L2	CO5
45.	With neat diagram , explain operation of a Schmitt trigger	6	L2	CO5
46.	Explain non inverting Schmitt trigger	10	L3	CO5
47.	Explain precision FWR using HWR	10	L2	CO5
48.	Explain non inverting Schmitt trigger operation	10	L2	CO5
49.	Explain zero crossing Detector	8	L2	CO5
50.	Design a half-wave precision rectifier using an op-amp.	6	L3	CO5

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